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of Engineers**
Europe Division

ENERGY SAVINGS OPPORTUNITY SURVEY

Final Submittal

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Pirmasens

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ES - EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Scope of Service - This final report is submitted in accordance with the General Scope of Work for an Energy Savings Opportunity Survey (ESOS) and the Detailed Scope of Work for ESOS in Pirmasens, Contract DACA 90-89-C-0096, as amended by the Resume of Negotiations.

Purpose - The overall objective of this study is to re-evaluate selected projects from two previously completed EEAP studies which have neither been implemented nor programmed for implementation; and to consider specific Energy Conservation Opportunities (ECOs) in buildings or areas which may have been overlooked.

Scope of Work - The Scope of Work includes:

1. Review of two previous EEAP studies and re-evaluation of ten ECIP projects selected by those studies. Five ECIP projects were selected in each of those studies.
2. Evaluate nine heat recovery ECOs, three occupancy sensor application ECOs, one power demand analyzer ECO and one landfill gas recovery ECO, all selected by the Base Facilities Engineer.
3. Ten additional buildings at Husterhoeh were selected by the Base Facilities Engineer for audit to identify potential ECOs which might have been overlooked during previous EEAP studies.
4. Performance of a limited site survey to gather data required to complete the ESOS study.
5. Prepare a comprehensive report to document work performed, results and recommendations, and prepare programming or implementation documentation for recommended ECOS.
6. Presentation of the Interim Report at the Pirmasens Military Community.

The presentation of the Interim Report was made on August 28, 1990, at the Headquarters, USAED, Europe (EUD), Phillips Building, Frankfurt/Main, Germany.

ES-2 ENERGY CONSUMPTION AND COSTS

The following tables present both the present and historical annual energy usage at each Kaserne. The energy data is shown by source.

The current fuel costs by source, provided by the Base Facilities Engineer are:

Electricity	\$23.44/MBtu (\$0.0800/kWh)
No. 2 Oil (Distillate)	\$ 4.69/MBtu (\$0.1718/liter)
No. 6 Oil (Residual)	\$ 3.68/MBtu (\$0.15498/kg)
Natural Gas	\$ 3.69/MBtu (\$0.0126/kWh)
Coal	\$ 2.99/MBtu (\$0.08357/kg)

These costs were used as the basis for all life cycle cost analyses in this ESOS study.

TABLE ES-1
HUSTERHOEH
ELECTRICITY

	FY 1984 KWH	FY 1985 KWH	FY 1986 KWH	FY 1987 KWH	FY 1988 KWH	FY 1989 KWH
OCT.	2,376,576	2,297,018	2,172,586	2,188,394	2,209,599	2,234,544
NOV.	2,206,090	2,152,499	2,331,278	2,125,438	2,422,959	2,833,980
DEC.	2,241,077	2,252,360	2,456,190	2,487,906	2,469,490	2,375,696
JAN.	2,756,621	2,878,447	2,669,355	2,580,861	2,451,040	3,092,057
FEB.	2,340,540	2,243,302	2,344,230	2,351,879	2,311,340	2,400,668
MAR.	2,438,345	2,417,202	2,563,208	2,632,690	2,629,270	2,395,471
APR.	2,151,963	2,313,346	2,292,600	2,054,095	2,229,758	2,084,412
MAY	2,082,949	2,179,799	2,055,907	1,488,366	2,154,605	2,173,407
JUN.	1,955,785	1,883,557	2,101,574	2,511,133	1,993,855	2,305,017
JUL.	1,692,782	1,959,782	1,985,100	2,016,329	1,887,920	2,147,681
AUG.	1,976,231	2,057,046	1,918,758	2,045,239	2,139,040	2,222,653
SEPT.	1,945,412	1,989,141	12,272,224	2,082,464	2,093,441	1,966,964
TOTAL	26,164,371	26,623,499	27,163,010	26,564,794	26,992,317	28,232,550

TABLE ES-2
HUSTERHOEH
NATURAL GAS

	FY 1989 CU. METERS -----
OCT.	0
NOV.	0
DEC.	0
JAN.	0
FEB.	148,145
MAR.	105,518
APR.	104,300
MAY	61,138
JUN.	29,027
JUL.	29,770
AUG.	31,170
SEPT.	54,120
TOTAL	563,188

TABLE ES-3
HUSTERHOEH
DISTRICT HEATING

	FY 1988 MWH	FY 1989 MWH
	-----	-----
OCT.	1,903	1,079
NOV.	1,935	2,238
DEC.	2,538	1,902
JAN.	2,388	2,392
FEB.	2,105	2,167
MAR.	1,825	1,788
APR.	1,466	1,611
MAY	613	791
JUN.	646	620
JUL.	297	395
AUG.	411	368
SEPT.	1,063	886
TOTAL	17,190	16,237

TABLE ES-4
HUSTERHOEH
ANTHRACITE COAL

	FY 1984	FY 1985	FY 1986	FY 1987
	METRIC TONS	METRIC TONS	METRIC TONS	METRIC TONS
	-----	-----	-----	-----
OCT.	215	378	156	0
NOV.	454	227	575	540
DEC.	422	373	197	4,713
JAN.	457	570	425	386
FEB.	365	437	359	421
MAR.	272	289	310	258
APR.	278	366	393	200
MAY	419	200	149	120
JUN.	93	128	97	120
JUL.	66	126	147	95
AUG.	122	150	222	71
SEPT.	202	155	208	41
TOTAL	3,365	3,399	3,239	2,665

TABLE ES-5
HUSTERHOEH
NO. 2 FUEL OIL

	FY 1984 LITRE	FY 1985 LITRE	FY 1986 LITRE	FY 1987 LITRE	FY 1988 LITRE	FY 1989 LITRE
OCT.	62,193	208,030	3,252	266,022	143,112	147,003
NOV.	442,414	305,374	458,161	172,051	248,859	261,282
DEC.	484,609	396,857	352,925	376,296	396,059	274,175
JAN.	478,644	656,785	412,431	415,194	226,079	288,715
FEB.	386,225	391,013	405,602	302,951	393,594	287,257
MAR.	394,999	376,004	402,869	383,117	325,054	267,657
APR.	251,160	306,010	419,645	196,973	183,301	188,986
MAY	196,644	260,843	154,907	157,296	85,049	116,808
JUN.	119,991	86,143	28,011	81,332	55,538	79,345
JUL.	30,162	0	11,602	88,902	45,110	60,270
AUG.	120,411	155,365	81,112	53,222	50,500	61,939
SEPT.	162,217	119,155	86,105	76,498	85,571	83,330
TOTAL	3,129,669	3,161,579	2,816,622	2,569,854	2,137,826	2,116,767

TABLE ES-6
HUSTERHOEH
NO. 6 FUEL OIL

	FY 1984 LITRE	FY 1985 LITRE	FY 1986 LITRE	FY 1987 LITRE	FY 1988 LITRE	FY 1989 LITRE
OCT.	296,827	233,668	218,819	207,198	244,033	195,675
NOV.	418,737	349,530	445,140	283,203	289,843	402,131
DEC.	514,847	462,791	415,236	408,695	394,730	421,780
JAN.	579,549	625,155	510,346	545,031	376,504	406,514
FEB.	542,249	462,492	519,942	495,772	415,769	237,208
MAR.	454,936	400,284	396,332	452,392	448,929	217,296
APR.	274,323	260,026	302,826	217,418	167,001	146,856
MAY	217,520	137,710	86,809	117,981	71,588	84,666
JUN.	64,854	70,903	66,308	50,356	53,275	191,367
JUL.	59,108	57,704	63,904	43,399	47,502	31,997
AUG.	60,705	57,704	60,607	49,520	55,800	29,900
SEPT.	113,908	87,808	111,009	62,492	68,946	0
TOTAL	3,597,563	3,205,775	3,197,278	2,933,457	2,633,920	2,365,390

TABLE ES-7
MUECHWEILER
ELECTRICITY
KWH

	FY 1984 KWH	FY 1985 KWH	FY 1986 KWH	FY 1987 KWH	FY 1988 KWH	FY 1989 KWH
OCT.	285,800	305,460	317,080	303,720	279,820	280,000
NOV.	339,220	180,020	286,860	280,920	285,640	270,400
DEC.	331,840	419,140	322,280	321,380	335,940	309,660
JAN.	316,040	319,840	332,560	331,300	275,980	301,840
FEB.	298,420	291,960	295,240	290,780	284,100	178,186
MAR.	321,320	324,080	291,740	310,880	234,740	324,200
APR.	272,860	265,700	298,260	292,180	237,600	324,200
MAY	236,760	267,200	259,080	239,960	245,720	252,786
JUN.	241,960	221,060	242,440	241,420	234,440	208,000
JUL.	245,160	242,120	252,060	247,800	234,660	232,440
AUG.	245,160	251,180	259,860	219,240	248,920	257,700
SEPT.	248,000	242,820	280,520	251,880	275,460	277,920
TOTAL	3,382,540	3,330,580	3,437,980	3,331,460	3,173,020	3,217,332

TABLE ES-8
 MUENCHWEILER
 BITUMINOUS COAL

	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989
	METRIC TONS	METRIC TONS	METRIC TONS	METRIC TONS	METRIC TONS	METRIC TONS
OCT.	315	281	277	250	321	323
NOV.	455	322	382	315	372	404
DEC.	467	376	353	390	440	405
JAN.	453	492	393	474	422	408
FEB.	440	431	444	368	425	363
MAR.	426	381	392	426	421	360
APR.	311	317	320	246	323	331
MAY	239	235	153	195	183	204
JUN.	140	156	153	136	188	171
JUL.	162	141	134	144	167	158
AUG.	152	142	146	144	163	157
SEPT.	223	144	208	191	230	198
TOTAL	3,783	3,418	3,355	3,279	3,655	3,482

TABLE ES-9
HOEHMUEHLBACH RAILHEAD
ELECTRICITY

	FY 1984 KWH	FY 1985 KWH	FY 1986 KWH	FY 1987 KWH	FY 1988 KWH	FY 1989 KWH
OCT.	8,320	10,392	11,972	10,148	6,412	6,232
NOV.	9,908	11,736	10,920	9,116	7,344	8,992
DEC.	11,856	11,176	13,656	10,984	10,088	9,320
JAN.	11,872	14,468	13,000	11,720	6,752	9,016
FEB.	13,112	14,220	12,284	10,568	6,272	8,992
MAR.	13,844	14,352	11,536	10,940	6,356	10,192
APR.	11,564	12,388	10,844	6,796	4,096	7,716
MAY	11,108	9,484	8,904	4,404	3,412	6,752
JUN.	7,608	6,860	8,524	2,956	3,984	6,836
JUL.	4,844	6,476	7,212	2,720	2,988	4,548
AUG.	5,316	7,884	5,836	2,768	4,604	4,376
SEPT.	6,472	8,140	7,984	3,320	5,220	3,052
TOTAL	115,824	127,576	122,672	86,440	67,528	86,024

TABLE ES-10
HOEHMUEHLBACH RAILHEAD
NO. 2 FUEL OIL

	FY 1984 LITRES	FY 1985 LITRES	FY 1986 LITRES	FY 1987 LITRES	FY 1988 LITRES	FY 1989 LITRES
OCT.	0	4,001	0	4,001	2,759	3,000
NOV.	11,144	7,503	6,999	6,000	7,200	7,858
DEC.	9,501	6,700	11,602	2,334	8,600	8,200
JAN.	6,000	16,803	11,102	6,608	6,700	9,000
FEB.	10,800	8,600	11,500	1,051	9,600	7,900
MAR.	6,999	7,593	7,400	8,400	8,200	5,800
APR.	6,000	7,200	4,603	4,500	4,300	4,800
MAY	3,600	4,800	6,999	1,900	600	1,500
JUN.	0	0	0	0	0	0
JUL.	0	0	0	0	0	0
AUG.	0	0	0	0	0	0
SEPT.	0	0	0	0	0	0
TOTAL	54,044	63,200	60,205	34,794	47,959	48,058

TABLE ES-11
MASSWEILER
ELECTRICITY

	FY 1984 KWH	FY 1985 KWH	FY 1986 KWH	FY 1987 KWH	FY 1988 KWH	FY 1989 KWH
	-----	-----	-----	-----	-----	-----
OCT.	109,900	121,640	125,860	117,000	112,580	99,400
NOV.	123,700	124,440	104,420	105,840	118,300	109,280
DEC.	125,200	131,160	112,080	108,000	141,260	121,100
JAN.	126,420	134,820	119,800	131,640	117,960	113,100
FEB.	115,440	121,940	112,660	106,640	104,180	104,080
MAR.	112,820	126,340	107,520	113,520	120,180	117,460
APR.	104,820	109,740	105,960	119,440	82,080	103,000
MAY	105,460	111,300	96,240	93,280	86,980	96,500
JUN.	99,360	91,640	93,160	91,340	95,800	108,740
JUL.	97,260	93,520	98,560	105,040	85,480	88,020
AUG.	110,060	97,380	96,620	89,260	91,560	102,020
SEPT.	93,400	108,000	110,140	95,020	99,420	108,560
TOTAL	1,323,840	1,371,920	1,283,020	1,276,020	1,255,780	1,271,260

TABLE ES-12
MASSWEILER
NO.2 FUEL OIL

	FY 1984 LITRES -----	FY 1985 LITRES -----	FY 1986 LITRES -----	FY 1987 LITRES -----	FY 1988 LITRES -----	FY 1989 LITRES -----
OCT.	0	24,003	24,355	27,012	13,800	16,277
NOV.	51,356	20,505	20,308	25,063	22,662	24,800
DEC.	25,702	21,308	43,512	1,566	29,349	27,118
JAN.	24,506	67,231	24,309	23,475	30,266	28,264
FEB.	49,300	47,419	43,520	9,658	34,173	26,430
MAR.	23,060	22,000	16,114	4,929	37,750	26,069
APR.	24,029	19,006	23,003	36,800	15,600	21,883
MAY	26,429	23,208	20,804	10,500	11,437	17,068
JUN.	0	0	0	12,482	8,000	11,500
JUL.	0	0	8,400	6,500	7,000	10,796
AUG.	30,033	28,100	7,359	5,518	6,900	11,072
SEPT.	0	0	10,145	7,982	13,100	11,210
TOTAL	254,415	272,790	241,829	171,485	230,037	232,487

TABLE ES-13
FISCHBACH
ELECTRICITY

	FY 1984 KWH	FY 1985 KWH	FY 1986 KWH	FY 1987 KWH	FY 1988 KWH	FY 1989 KWH
	-----	-----	-----	-----	-----	-----
OCT.	249,360	291,480	286,340	289,660	263,420	240,160
NOV.	263,140	301,080	260,380	266,060	241,520	258,000
DEC.	294,820	295,700	292,880	331,820	299,540	290,220
JAN.	288,840	325,560	296,620	288,680	257,100	277,180
FEB.	274,920	287,520	266,060	288,500	256,960	260,440
MAR.	310,040	306,660	262,900	293,180	307,820	284,080
APR.	275,420	281,540	256,880	269,260	206,880	257,960
MAY	283,460	258,100	229,900	227,520	208,960	223,000
JUN.	226,740	214,440	205,080	220,600	203,720	226,100
JUL.	215,320	228,020	213,820	229,500	202,060	201,520
AUG.	235,720	229,160	214,160	206,100	211,740	225,180
SEPT.	234,760	223,200	248,060	221,800	232,760	238,300
TOTAL	3,152,540	3,242,660	3,033,080	3,132,680	2,892,480	2,982,140

TABLE ES-14
FISCHBACH
NO. 2 FUEL OIL

	FY 1984 LITRES	FY 1985 LITRES	FY 1986 LITRES	FY 1987 LITRES	FY 1988 LITRES	FY 1989 LITRES
	-----	-----	-----	-----	-----	-----
OCT.	38,451	61,841	32,565	98,744	59,882	59,572
NOV.	156,103	103,120	148,283	112,163	93,636	96,179
DEC.	133,353	108,105	108,382	24,688	99,503	108,017
JAN.	116,815	187,151	160,180	60,210	125,529	111,020
FEB.	142,764	125,310	143,419	13,950	123,122	107,084
MAR.	140,356	141,806	103,771	40,352	111,399	100,200
APR.	92,434	109,710	126,294	67,584	85,130	87,616
MAY	37,868	63,120	28,610	33,030	22,150	33,740
JUN.	30,086	0	0	17,710	17,220	27,293
JUL.	0	0	0	14,800	13,788	16,665
AUG.	30,021	0	36,017	19,714	12,699	17,400
SEPT.	76,778	55,614	29,192	16,220	30,150	35,977
TOTAL	995,029	955,777	916,713	519,165	794,208	800,763

ES-3 RE-EVALUATED PROJECTS AND NEW ECO RESULTS

Re-evaluated ESOS

Each of the two previous Energy Engineering Analysis Program (EEAP) Studies proposed five Energy Conservation Investment Program (ECIP) projects. These projects consisted of one or more Energy Conservation Opportunities (ECO).

Each of these ECOS was re-evaluated during this study to determine if current ECIP criteria can be met.

In addition, other potential funding programs were considered for the re-evaluated ECOS.

Table ES-15 lists each re-evaluated ECO, identifies the previous EEAP project, provides life cycle cost analysis results and the potential funding program for each ECO.

Other ECOS

In addition, all other ECOS considered during the course of this study are shown on Table ES-15.

Recommended ECOS

Recommended ECOS are indicated by the inclusion of a potential funding program in the right hand column of the Table.

ECOS which were rejected are indicated by "NA" in the right hand column of Table ES-15.

ECIP Projects Developed

No ECIP projects were developed during this ESOS study. The ECOS which met both the SIR criteria ($SIR \geq 1.0$) and the simple payback criteria ($SPB \leq 4.0$ years) do not meet the minimum cost of \$200,000 even if all are combined into one project.

We have, however, included those ECOS with $SPB \leq 6.0$ years in Table ES-15 under the heading "ECIP" since these ECOS did meet two of the three criteria.

The following ECOs are included:

- 6.5 Exterior Lighting Conversion
- 6.7 Occupancy Sensors
- 6.18 Caulking
- 6.27 Thermostatic Radiator Valves
- 6.28 Flow Restrictors
- 6.41 Boiler Turbulators

Non-ECIP Projects Developed

PCIP - The following ECOs are included as a potential PCIP project:

- 6.27 Thermostatic Radiator Valves
- 6.41 Boiler Turbulators

PM (Preventative Maintenance) Teams - The following ECOs are included as a potential PM project:

- 6.15 Window Weatherstripping
- 6.16 Personnel Door Weatherstripping
- 6.17 Vehicular Door Weatherstripping
- 6.18 Caulking
- 6.27 Thermostatic Radiator Valves
- 6.28 Flow Restrictors
- 6.30 Pipe Insulation

OMA (Operations and Maintenance) - The following ECOs are included as a potential OMA project:

- 6.27 Thermostatic Radiator Valves
- 6.41 Boiler Turbulators

All project data for the above ECOs and projects is included in Table ES-15.

TABLE ES-15
SUMMARY OF REEVALUATED
PROJECT ECOS AND NEW ECOS

PREVIOUS PROJECT (1)	NO.	TITLE	TOT. INV. (\$)	ELECT (MBTU/YR)	DIST (MBTU/YR)	RESID (MBTU/YR)	NAT GAS (MBTU/YR)	COAL (MBTU/YR)	NO MAINT. SIR	3% MAINT. SIR	3% MAINT. SPB (YRS)	QUALIFIES FOR FUNDING PROGRAM (2)	
W2 W2 P.E.R. 4	6.4	INTERIOR LIGHTING CONV.	92883	339	0	0	0	0	0.98	11.68	0.63	17.97	NA
	6.5	EXTERIOR LIGHTING CONV.	2925	27	0	0	0	0	2.51	4.57	2.13	5.37	ECIP
	6.6	LIGHTING SYSTEM REPLACE.	359417	678	0	0	0	0	0.51	22.62	0.16	69.83	NA
	6.7	OCCUPANCY SENSORS	6517	61	0	0	0	0	2.53	4.54	2.17	5.28	ECIP
	6.8	POWER DEMAND ANALYZERS											NA
P.E.R. 1&3, W1	6.9	CONTROL LIGHT LEVELS AUTO.											NA
	6.10	REPLACE INCANDESCENT FIXTURES	1418385	0	7749	0	22778	0	1.44	11.78	1.09	18.19	NA
	6.11	ROOF INSULATION											NA
	6.12	ATTIC INSULATION											NA
	6.13	WALL INSULATION	14983	0	590	0	0	0	3.16	5.41	2.82	6.46	NA
W2 W2 W2 W4 W4 W4	6.14	BASEMENT CEILING INSULATION											NA
	6.15	WINDOW WEATHERSTRIPPING	86775	0	284	0	1463	0	1.31	12.89	0.96	20.98	FM, S-H
	6.16	PERSONNEL DOOR WEATHERSTR.	1787	0	16	0	0	0	1.62	9.30	1.29	12.70	FM, S-H
	6.17	VEHICULAR DOOR WEATHERSTR.	19356	0	154	0	39	0	0.76	22.41	0.42	67.40	FM
	6.18	CAULKING	10079	0	0	0	597	0	3.68	4.57	3.33	5.30	ECIP, FM, S-H
W4 W4 W3 P.E.R. 3	6.19	REDUCE WINDOW AREA	20252	0	374	0	124	0	1.86	9.16	1.52	12.61	NA
	6.20	REPLACE VEHIC. DOOR W/WALL	27487	0	294	0	0	0	0.86	19.91	0.51	49.36	NA
	6.21	STORM WINDOWS	955242	0	1414	0	5031	0	0.45	37.92	0.10	---	NA
	6.22	DOUBLE GLAZED WINDOWS	374687	0	0	0	1801	0	0.30	56.38	-0.05	-82.23	NA
	6.23	MODIFY SKYLIGHTS											NA
P.E.R. 3 P.E.R. 5, W2 P.E.R. 1&5, W4	6.24	REPLACE DOORS											NA
	6.25	INSTALL VESTIBULES	33990	0	0	0	305	0	0.56	30.20	0.21	313.42	NA
	6.26	DESTRATIFY AIR	269700	-211	1585	0	4543	0	1.30	14.18	0.96	24.11	NA
	6.27	THERMOSTAT RADIATOR VALVE	95788	0	10889	0	0	0	6.61	1.88	6.33	1.99	ECIP, PCIP, CMA, FM
	6.28	FLOW RESTRICTORS	64180	0	874	0	2370	0	3.39	5.00	3.04	5.87	ECIP, FM, S-H
W2 W5 W2 W4	6.29	BUILDING LTM CONTROLS	22429	0	129	0	121	0	0.80	21.33	0.45	58.95	NA
	6.30	PIPE INSULATION	466750	0	0	0	5046	0	0.67	25.07	0.32	100.04	FM
	6.31	VENTILATION HOODS	35077	-246	1139	0	0	0	0.72	-81.49	0.37	-23.81	NA
	6.32	HEAT RECOV. KITCHEN HOODS	310496	0	2310	0	6065	0	1.81	9.35	1.46	12.97	NA
	6.33	MESS HALL AIR HEAT RECOV.	257436	-21	0	0	731	0	0.15	116.62	-0.19	-46.88	NA
P.E.R. 2	6.34	MESS HALL WATER HEAT RECOV.	32007	-6	0	0	737	0	1.38	12.40	1.03	19.73	NA
	6.35	LAUNDRY EX. AIR HEAT RECOV.	65372	0	0	0	1070	0	1.02	16.56	0.67	32.80	NA
	6.36	LAUNDRY WATER HEAT RECOV.	53195	-10	0	0	444	0	0.47	37.65	0.12	---	NA
	6.37	BOILER TRIM CONTROLS	268898	0	1068	0	0	0	0.32	53.69	-0.03	-88.74	NA
	6.38	BOILER BLOWDOWN CONTROLS											NA
P.E.R. 4 P.E.R. 4 P.E.R. 4	6.39	INSTALL COMBUSTION CONTROLS											NA
	6.40	FLUE GAS DAMPERS	20797	0	0	142	637	0	2.33	7.24	1.98	9.24	NA
	6.41	BOILER TURBULATORS	19098	0	0	0	6937	0	22.58	0.75	22.24	0.76	ECIP, PCIP, CMA
	6.42	DHW HEAT PUMPS	90690	-1063	0	337	1653	0	-1.79	-5.16	-2.14	-4.47	NA
	6.43	BOILER ECONOMIZERS	205327	0	0	0	4863	0	1.47	11.44	1.12	17.39	NA
W4 W4 W4 W4 W4	6.44	ZONE MULT-USE FACILITY											NA
	6.45	RESCHEDULE UTILIZATION											NA
	6.46	COMMISSARY RFG. HEAT RECOV.	118413	-70	0	0	4445	0	2.17	8.03	1.83	10.55	NA
	6.47	REFRIG. GAS HEAT RECOV.	982427	-40	0	0	4013	0	0.24	70.79	-0.11	-63.38	NA
	6.48	REFRIG. GAS HEAT REC. HUST.	50175	-87	0	0	453	0	0.10	-139.59	-0.25	-26.86	NA
P.E.R. 3	6.49	REFRIG. GAS HEAT REC., 4000											NA
	6.50	PARTIAL THERMAL STORAGE	51288										NA
	6.51	LANDFILL GAS RECOVERY	534866	-699	0	0	3556	0	-0.17	-38.42	NA	NA	NA

NOTE (1): DESIGNATES ECIP PROJECT FROM PREVIOUS ECIP STUDIES. FOR EXAMPLE, W1 INDICATES THE ECO WAS INCLUDED IN WESTON'S ECIP PROJECT 1.
P.E.R. 1 IS POPE, EVANS, AND ROBBINS ECIP PROJECT 1.

NOTE (2): ECIP, ENERGY CONSERVATION INVESTMENT PROGRAM (ASSUMING 6 YEAR SIMPLE PAYBACK. SEE TEXT)
PCIP, PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
CMA, OPERATIONS AND MAINTENANCE
FM, PREVENTATIVE MAINTENANCE TEAMS

ES-4 POTENTIAL ENERGY AND COST SAVINGS

The total potential energy and cost savings are summarized by fuel source below. These potential savings assume implementation of all recommended ECOs:

Table ES-16
Energy and Cost Savings

<u>Source Energy</u>					<u>Cost Savings</u>
<u>Electricity</u> <u>(MBtu/yr)</u>	<u>No.2 Oil</u> <u>(MBtu/yr)</u>	<u>No.6 Oil</u> <u>(MBtu/yr)</u>	<u>Nat. Gas</u> <u>(Mbtu/yr)</u>	<u>Coal</u> <u>(MBtu/yr)</u>	<u>1st Year</u> <u>Savings (\$)</u>
88	12,217	-0-	16,452	-0-	\$120,069
					28,757

Table ES-17
Energy and Cost Savings by Funding Program

<u>Funding Program</u>	<u>Source Energy (MBtu/yr)</u>			<u>Cost Savings</u>
	<u>Elect</u>	<u>No. 2 Oil</u>	<u>Nat. Gas</u>	<u>1st Year Savings (\$)</u>
ECIP	88	11,793	9,904	\$93,918
PCIP	-0-	10,889	6,937	\$76,667
PM	-0-	12,217	9,515	\$92,408
S-H	-0-	1,174	4,430	\$21,853
OMA	-0-	10,889	6,937	\$76,667

The reader should use caution when interpreting Table ES-17. Many of the ECOs are considered eligible for more than one Funding Program and, therefore, the potential savings are duplicated in Table ES-17. For instance, ECO 6.27 and 6.41 could be funded by either PCIP or OMA. The potential savings are shown for each funding program.

ES-5 RECOMMENDATIONS FOR FUTURE ESOS STUDIES

Introduction - The following are recommendations to improve future ESOS studies. The recommendations have been developed by Stanley Consultants, Inc., (SCI), while working on this study for Pirmasens Military Community. These recommendations range from important money saving items to small time saving items.

- The ECOs should be examined for their individual merits and as a part of a combined system for the Building Envelope Group and the Boiler Controls System Group.
- Packaging of ECOs for Project Implementation. For economic reasons, including the minimization of mobilization costs, compatible ECOs, such as the Building Envelope and Boiler Controls System, should be included into the same contract package.
- The U/7A should configure a hybrid grouping of key and knowledgeable staff and consultants from the A/E industry to work jointly on future ESOS analysis projects. This formation of a hybrid concept brings together the "best" of both parties. From the U/7A, a great depth of knowledge of local conditions and methods, and from the consultant, expertise in analysis and design, as well as latest technologies.
- This hybrid team would then screen available and applicable lists of likely ECOs from Pirmasens and other sources for use in the set of conditions to be examined.

The team would collect field data and, in a quicker fashion, develop conclusions and recommendations for implementation and actions.

After the examination of a representative number of installations/Kasernes, the team would then develop a generic set of recommendations. This will permit the earliest preparation of project programming and implementation actions in a short time following the actual

inspection or application of empirically derived preproject preparations.

- Alternative funding sources are recommended. These include:

ECIP	For which there is very little opportunity.
PCIP	For productivity enhancing capital investments.
OMA	For both .p2 and FHMA funding sources.

Preventative Maintenance
Teams (PM Teams)

Teams organized at the troop unit level for in-house O&M, and repairs.

Self-Help Especially applicable by FH dwellers, troop units.

- Value Engineering Opportunities. A number of the ECOs are judged to be applicable for VE during the design stages for either new construction or rehabilitation. Applicable ECOs would include the Heat Recovery Group. The view is that implementation of such ECOs is very costly as a retrofit, thus incorporating them into the design during construction or rehabilitation is much more cost effective.
- Concurrent Actions. It is recommended that such ECO actions as replacing pipe insulation, lighting upgrades, and related building envelope items for improved air-tightness be carried out concurrent with such actions as exterior building waterproofing, replacement of gutters and downspouts, etc., as a way of reducing mobilization costs.
- Have previous report's documentation available to the consultant.
- Add a preliminary report to the project to define the approach to the study.

- Original documents should be checked more carefully by the U/7A for obvious mistakes.
- LCCID economic factors, such as the cost of money, inflation rate, and life of the equipment, could be changed; then more ECOs could meet ECIP criteria.
- The "General Scope of Work," "Detailed Scope of Work," and the "Resume of Negotiations" should be included in each submittal. This would provide reviewers with all pertinent contract requirements on which to base their reviews.